descend readily, and without any danger of accident, owing to the operation being performed with too great rapidity, which has been a defect in other machines of the kind, with only a single rope.

In the year 1829 the Society presented to Mr. D. Davies their large silver medal for a somewhat similar contrivance (an account of which is published in their 47th vol.), by which, however, the descent only is provided for. An apparatus on Mr. Davies's plan may be seen in the Society's repository.

No. XIV.

ON THE HYGRO-BAROMETER.

By Andrew Ross.

January 24th, 1844.

DAVID POLLOCK, ESQ. F.R.S. V.P. IN THE CHAIR.

Of all the instruments employed in meteorological observations, the hygrometer and barometer are the most important; and as progress in the science of meteorology mainly depends on the accumulation of well-observed and well-registered facts, the hygro-barometer has been so arranged that the height of the barometric column and the depression of the dew-point may be registered from mere inspection, while these may be combined, as will hereafter be described, to exhibit in a popular manner the real state of the weather.

The three most remarkable fluctuations which occur in the atmosphere, are its temperature, its weight, and its dryness, and these are measured with the instruments which compose the hygro-barometer. The electrical state

of the atmosphere depends in a degree upon these fluctuations, and it is probable that to them, in combination with electricity, currents, winds, and storms, are wholly attributable.

The connexion which has been observed between fluctuations of the barometer and changes of the weather has given rise to the practise of engraving on that instrument the words, "Fair," "Rain," &c., in a manner which would imply more precision in such predictions than is really found to exist. A great depression in the barometer will, doubtless, be followed by wind, because such a sinking in the body of the atmosphere as is marked by a fall of one or two inches of mercury, will be speedily restored by a rush of air from other parts of the globe; and there is always a probability that wind will be accompanied by rain, because warmer air charged with moisture may be brought to our colder regions, where the moisture will be condensed into rain, or colder air may be brought to mix with that already existing, and cause it, therefore, to precipitate part of its moisture. The first, however, is the more common cause of rain. Winds from the east and west, not differing greatly in temperature from our own air, affect us principally from the circumstance that the western gales passing over the Atlantic are more charged with moisture than the eastern which have traversed the continents of Asia and Europe. This shews the necessity of combining the indications of the hygrometer with those of the barometer in our prognostications of the weather.

The hygro-barometer by which these indications can be combined, comprises a barometer of the usual construction and two thermometers. One of the thermome-

ters is of the ordinary kind, the other has its bulb kept constantly moist by a small skein of silk immersed in water, contained in the fountain bottle placed between the two thermometers. These are employed to measure the quantity of moisture in the atmosphere.

Numerous contrivances have been applied to the barometer for this purpose, principally of animal and vegetable tissues and fibres, such as whalebone and the beard of the wild oat, which are peculiarly affected by changes of dryness and moisture. These, however, only exhibit the change, they do not measure it. Professor Daniell was the first to invent an instrument by which the absolute quantity of water in the atmosphere could be ascertained. It points out the temperature to which the existing atmosphere must be reduced before it will begin to deposit its moisture; and this temperature is called the dew-point. As an exact scientific instrument, Daniell's hygrometer cannot be surpassed, but the time occupied and the nicety required in making the observations, render it too tedious for popular use; but Dr. Apjohn having compared the difference of temperature as obtained by the wet and dry bulb thermometers with the indications of Daniell's hygrometer, has given a formula for the computation of the dew point below the temperature of the atmosphere, which affords the means of readily obtaining this difference; and it is satisfactory to know that Dr. Apjohn's empirical formula is corroborated by the result of a purely theoretical investigation made by Professor Kupffer.

In the centre of the frame is an engraved table of figures, the object of which is to give the number shewing the depression of the dew-point below the existing temperature, and is computed from the formula before

mentioned. It consists of two columns of figures; the one headed temperature, and the other difference of temperature. The figures of the first column, headed "temperature," direct to horizontal columns of figures on the right, and refer to the ordinary thermometer; the other column of figures is headed "difference of temperature," and the large figures in the upper line refer to the difference of the indications of the two thermometers, and head perpendicular columns of figures below them.

Above this table is an ivory sliding scale on the right hand, and a fixed scale on the left; that on the right refers to the barometer, and is marked with divisions corresponding to tenths of inches on the scale for measuring the height of the column of mercury in the ordinary barometer; and that on the left refers to the hygrometer, and is marked with divisions corresponding to degrees of depression of the dew-point as given by the table. There is a brass index sliding in and moving with the sliding barometer scale; also a blackened index sliding in the fixed scale. The brass index points to the fixed hygrometric scale, which has the usual words, "Rain," "Changeable," and "Fine," engraved upon it. The blackened index is merely to register the observation.

The places of the various states of the weather, "Rain," "Changeable," and "Fine," on the hygrometric scale, have been fixed from a mean of three years' Meteorological Journals of the Royal Society, and were obtained as follows:—where the height of the barometer was 30 inches, and the column of remarks indicated changeable, the depression of the dew-point was taken from its column, and the mean of all cases during the three years gave ·6 for the mean depression of the dew-

point; and the place of "Changeable" is accordingly placed opposite the division 6 on the hygrometric scale. The place of "Fine," which is opposite the division 12, was obtained in the same manner; and the place of "Rain" is 6, or where there is no difference between the existing temperature and the dew-point, as then the moisture of the atmosphere will begin to be deposited.

The barometer, as before mentioned, is of the ordinary construction, the height of the mercury being indicated, as usual, by inches and parts; but the corresponding numbers on the sliding scale have variable spaces, for upon comparing the column of remarks in the before mentioned journals with the variations of the height of mercury in the barometer (the dew-point being constant) it was seen that the probability of rain was in an increased proportion, with equal decrements of the column of mercury below 30 inches; also, that above 30 inches the probabilities of fine weather were in a diminishing proportion with equal increments of the column, and the divisions below and above 30 inches on the sliding scale are accordingly in these increasing and diminishing proportions.

The manner of using the instrument so as to combine the indications of the hygrometer with those of the barometer, is as follows:—

Adjust the sliding ivory scale so that the number 30 coincides with the fixed index division on the frame of the ivory scale.

Ascertain the temperature of the air by the ordinary or dry bulb thermometer, also the difference of temperature as indicated by the wet and dry bulb thermometers; then refer to the table, and where the vertical column and horizontal row of figures under these num-

bers intersect, a number will be found, which is the depression of the dew-point below the temperature of the atmosphere. Now adjust the brass index to point to this number on the hygrometric scale, and this will indicate the state of the weather due to the hygrometric state of the atmosphere. Next ascertain the number indicating the height of the mercury in the barometer, and adjust the sliding scale so that this number may coincide with the index division on the edge of the frame. As the brass index moves with this slide it will be carried away from its former position with the sliding scale, which will combine the barometric influence, and the index will now point out the state of the weather due to the combined influences of both the hygrometric and barometric states of the atmosphere.

No. XV.

ON STOVES.

THE following stoves were exhibited and described by their respective inventors.

1. Jones's portable and economical stove.
2. Wright's, formerly known as Joyce's, stove.
3. Nettleton's safety-pedestal stove.
4. Brown and Green's ventilating stove.
5. Walker's self-feeding phœnix stove.
6. Edwards', or Dr. Arnott's stove.
7. Nott's patent stove.